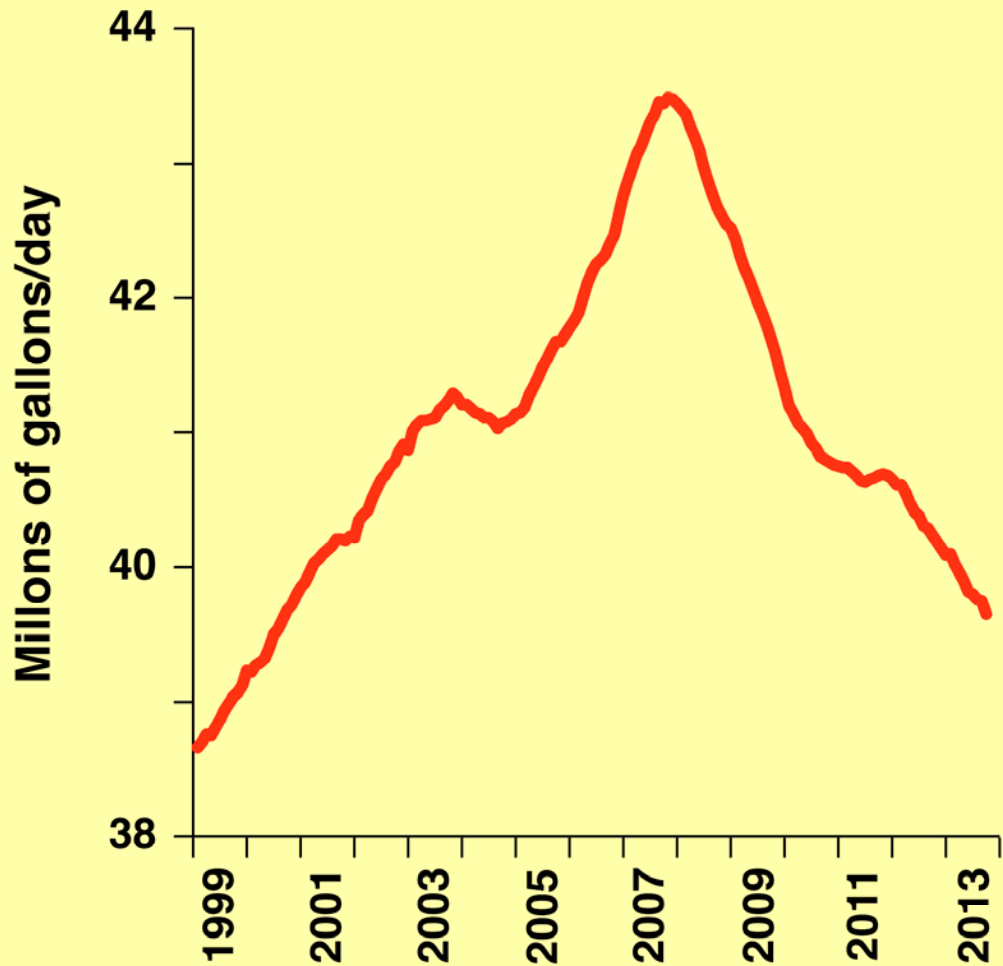


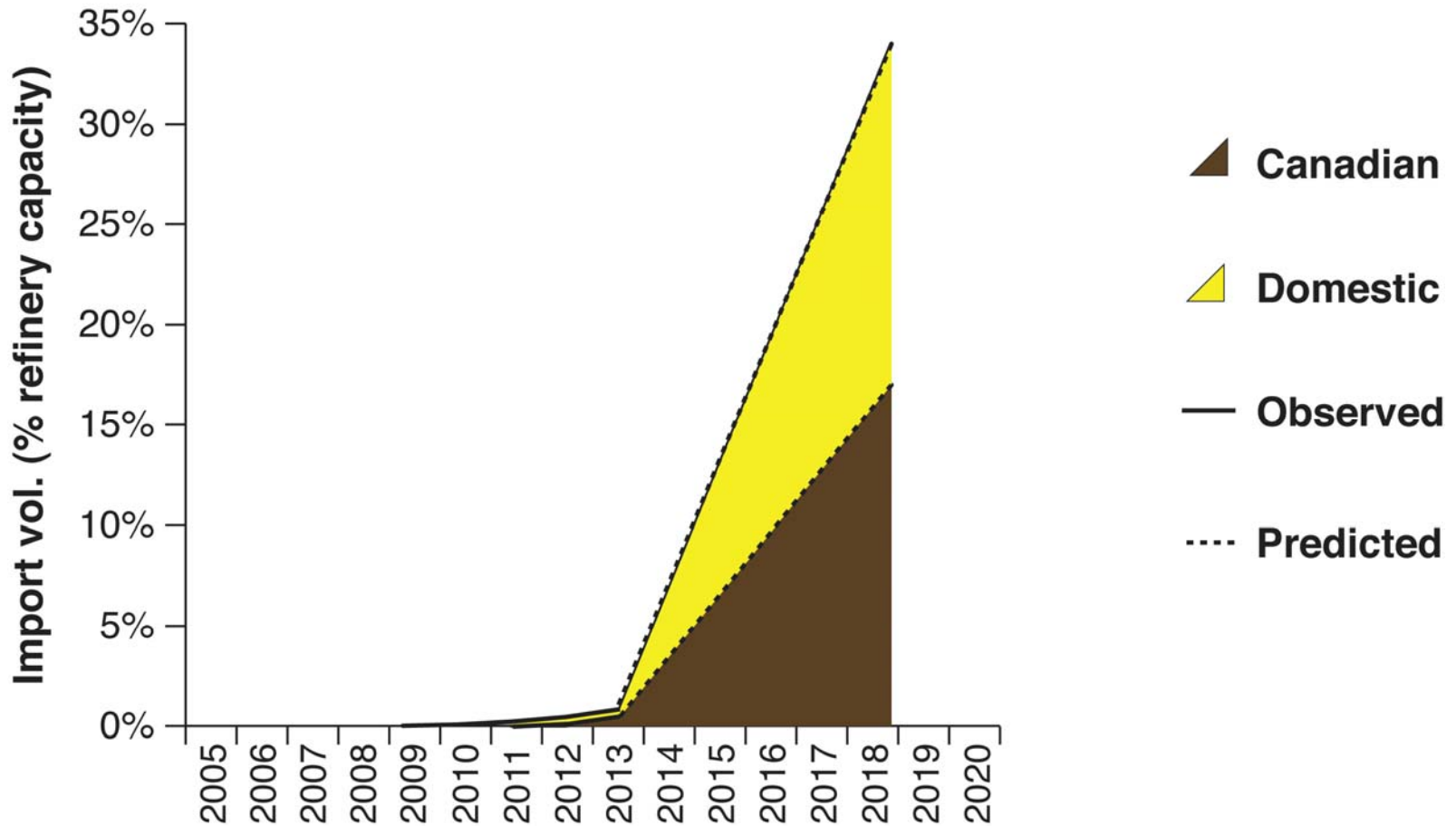
# California Crude by Rail Workshop Berkeley, CA — 6/25/14

Presentation by  
Greg Karras, Senior Scientist  
Communities for a Better Environment



**California gasoline sales, Jan 1999–Sep 2013**

Data: U.S. Energy Information Admin. Chart: CBE.



## California Crude Imports by Rail—observed / predicted

Observed (2009–2013): data from CEC ([http://energyalmanac.ca.gov/petroleum/statistics/2013\\_crude\\_by\\_rail.html](http://energyalmanac.ca.gov/petroleum/statistics/2013_crude_by_rail.html)). Predicted based on utilization of capacity proposed for Alon Bakersfield, Plains Bakersfield, Phillips 66 Santa Maria, Valero Benicia & Wilmington, WesPac Pittsburg and Kinder Morgan Richmond (proposed and repurposed terminals). Percentage of refinery capacity based on 2014 statewide crude capacity reported in *Oil & Gas Journal* (2.03 MM b/cd).

Greater selenium concentrations in crude slates match greater Bay discharge rates for the four largest discharging refineries.

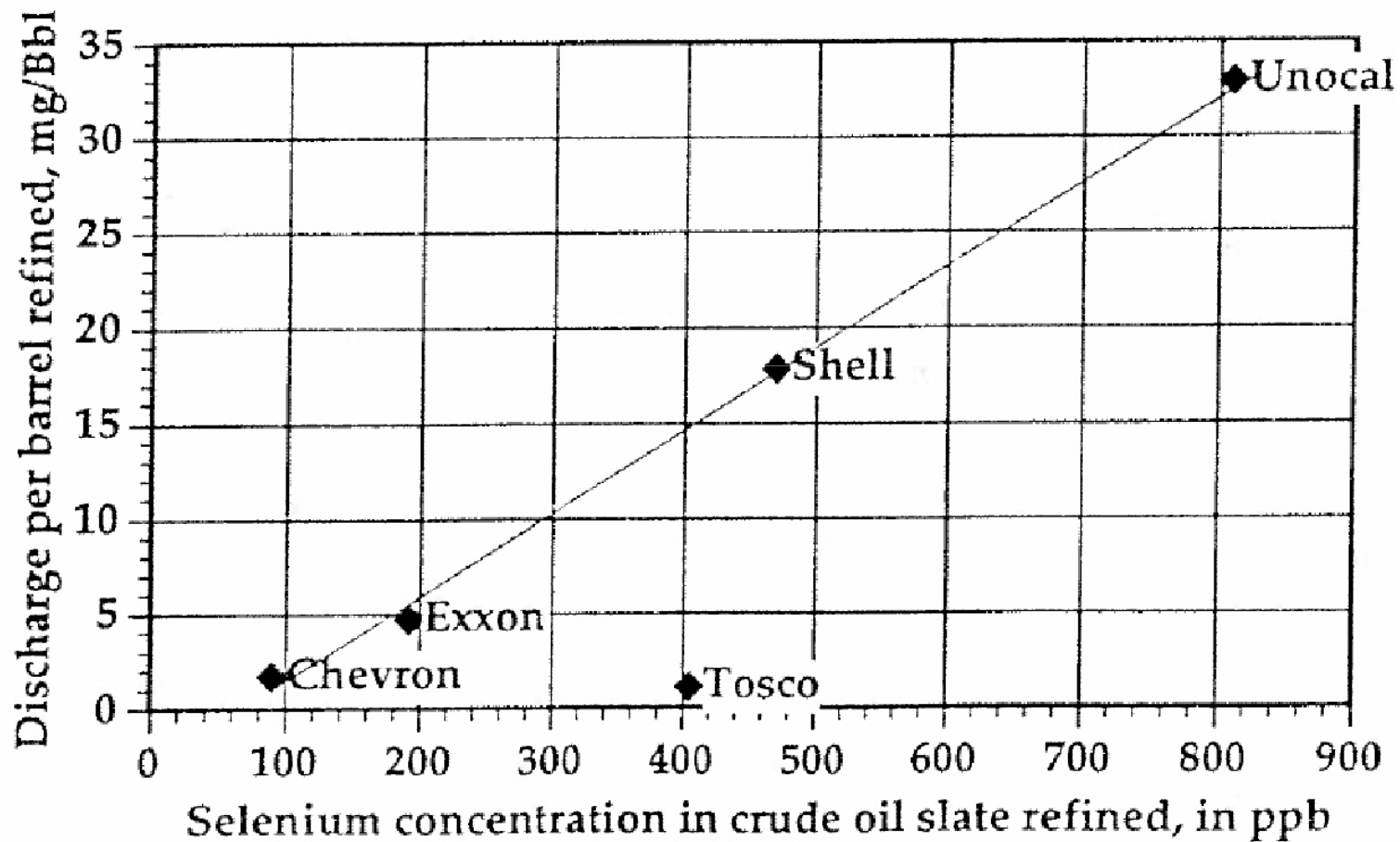
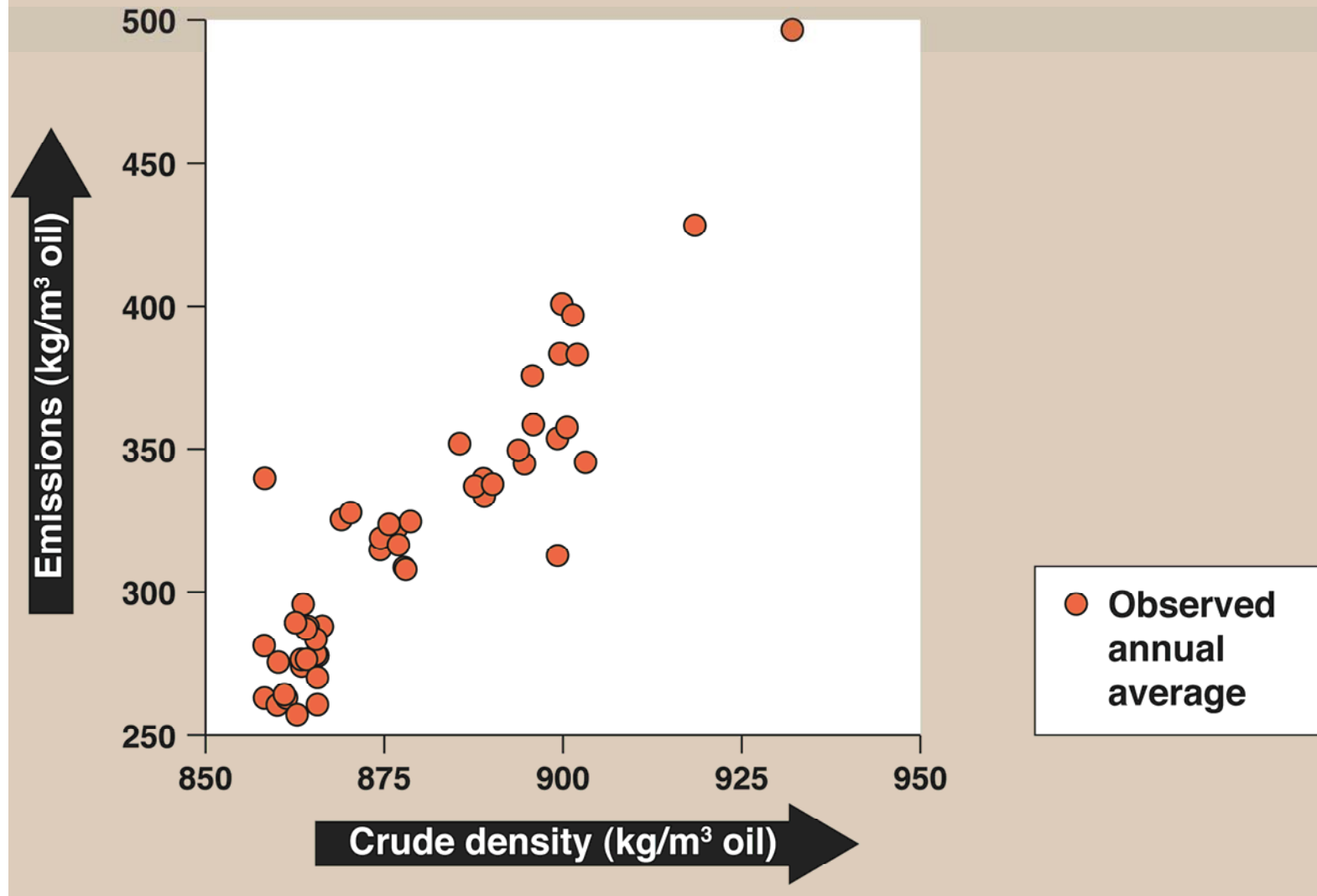
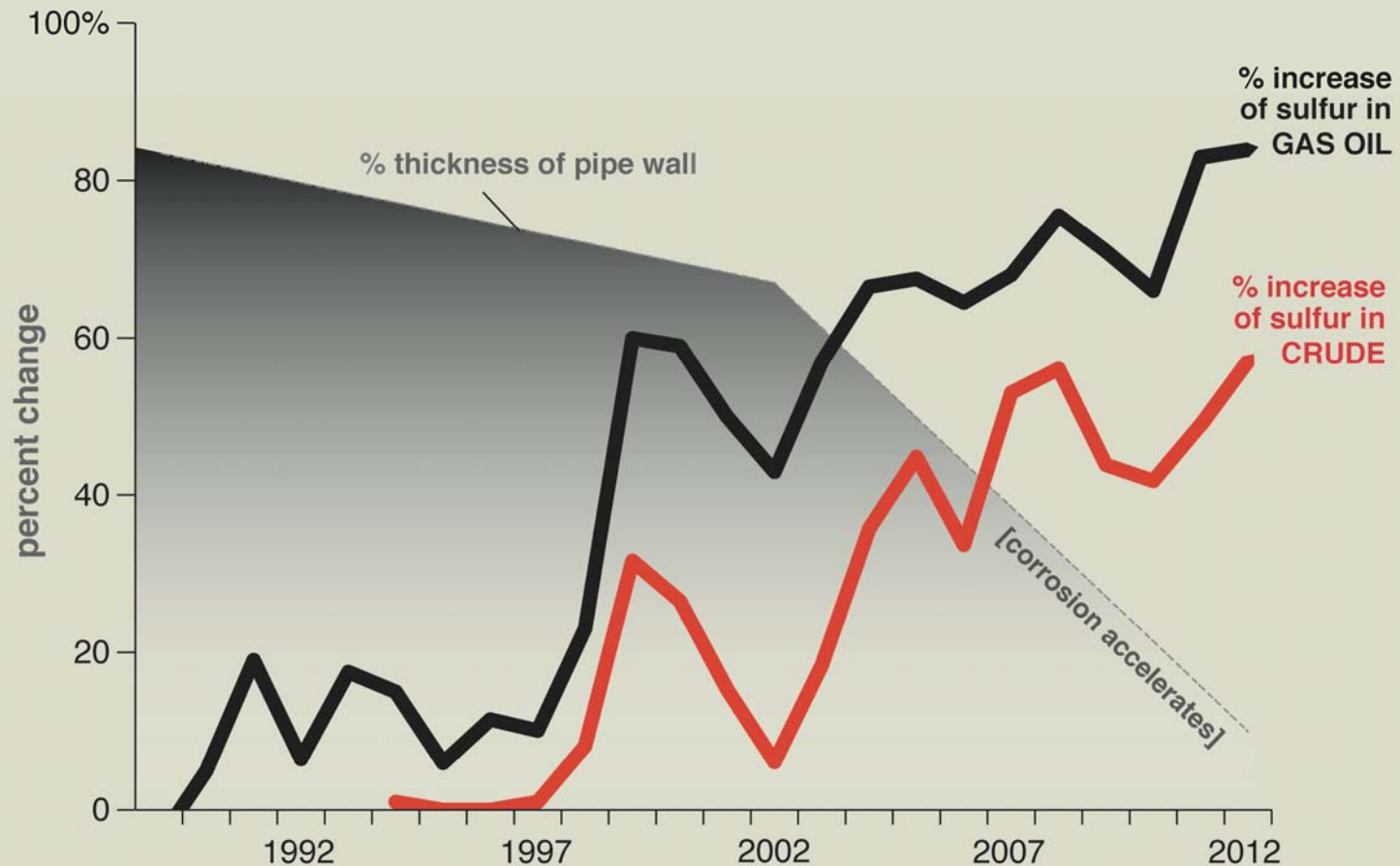


Chart from *Dirty Crude*; CBE Report No. 94-1. CBE, 1994.

## Refinery CO<sub>2</sub> emissions v. crude feed density



American Chemical Society (2010) & Union of Concerned Scientists (2011) data.



**RICHMOND REFINERY FEEDSTOCK QUALITY / 4-SIDECUT PIPE CORROSION 1989–2012**



**thickness of  
4-sidecut pipe wall**



**sulfur in gas oil**  
increase determined using  
% of 1984 average



**sulfur in crude feed**  
increase determined using  
% of 1996 average

Analysis and chart: CBE Pipe thinning and gas oil data from CSB interim report; see CBE 9 April 2013 memo to CSB for crude oil data.

[www.cbecal.org](http://www.cbecal.org)

4/19/2013

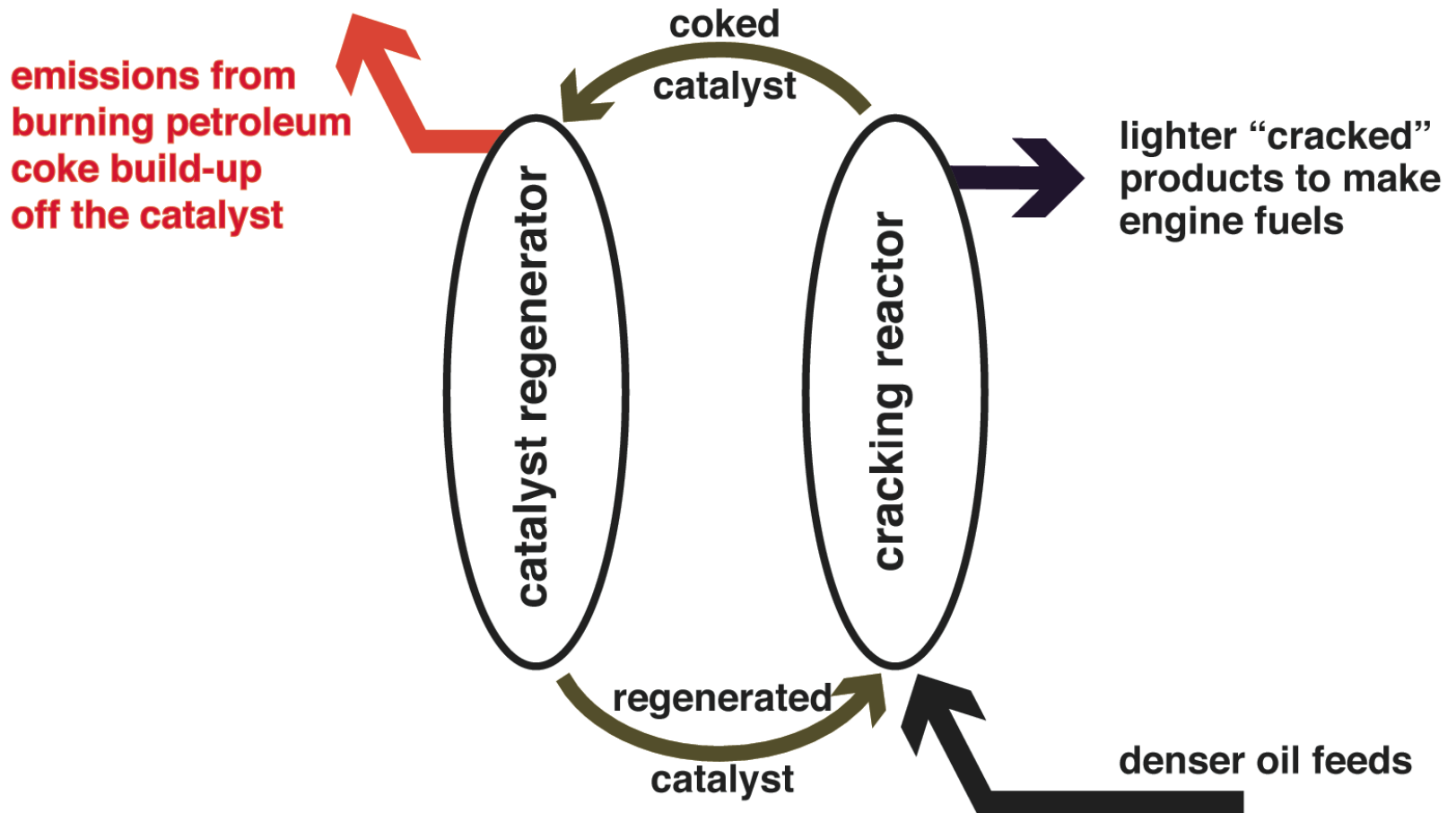


## **Shale oil deposits removed from pipeline**

**Potential hazards in refining shale oils include:**

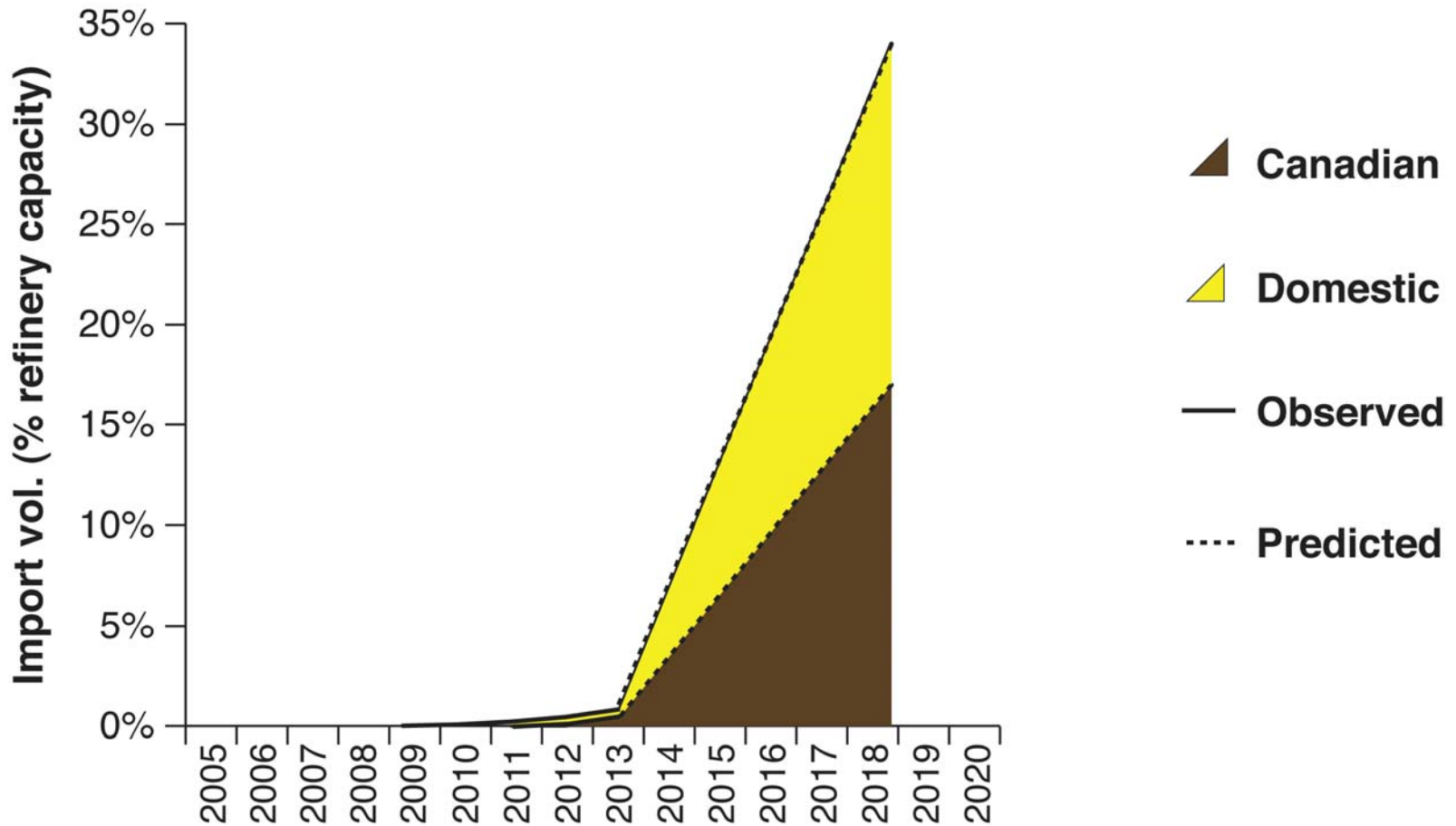
- **‘Waxy’ and scale deposits, plugging, flocculation, fouling, amine-chloride underdeposit corrosion, sulfidic corrosion, and (in blends with heavy oils) increased coke formation.**

**(Source: <http://www.hydrocarbonprocessing.com/Article/3223989>)**



## Catalytic cracking of heavy gas oil creates and burns coke





## California Crude Imports by Rail—observed / predicted

Observed (2009–2013): data from CEC ([http://energyalmanac.ca.gov/petroleum/statistics/2013\\_crude\\_by\\_rail.html](http://energyalmanac.ca.gov/petroleum/statistics/2013_crude_by_rail.html)). Predicted based on utilization of capacity proposed for Alon Bakersfield, Plains Bakersfield, Phillips 66 Santa Maria, Valero Benicia & Wilmington, WesPac Pittsburg and Kinder Morgan Richmond (proposed and repurposed terminals). Percentage of refinery capacity based on 2014 statewide crude capacity reported in *Oil & Gas Journal* (2.03 MM b/cd).